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DRAWINGS ATTACHED

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(54) TRANSIT TICKET HAVING AN INFORMATION ENCODABLE MATRIX FOR AUTOMATIC FARE COLLECTION SYSTEMS

(71) We, GENERAL ELECTRIC COMPANY, of 1 River Road, Schenectady 12305, State of New York, United States of America; a corporation organised and existing under the laws of the State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to transit tickets and more particularly to a transit ticket having an information encodable matrix for use in automatic fare collection systems.

Much interest has been expressed in recent years in rapid transit systems for moving a maximum amount of people in a minimum amount of time and space. The interest in these systems is increasing due to the growth of suburban communities surrounding large cities and the necessity of moving people from the suburbs into and out of the city as well as within the city. The traffic congestion in and around these cities has become an increasing problem making it necessary to provide for greater use of rapid transit systems.

Most transit systems use either a single fare structure or a graduated fare structure. In a single fare structure, the customer may enter the system at any station on payment of the single fare and may travel to any other station within the system. In a graduated fare structure, the customer normally must purchase a special ticket which is generally only useable from the station where purchased to another specific station of the system. It is understood that many times tickets may be purchased at some central location for use at various stations of the system. The graduated fare structure is more complicated and costly to administer than is the single fare structure because it usually requires a plurality of separate tickets of different types, a plurality of offices for issuing such tickets and transit system personnel, such as conductors, to be sure that the customer has properly paid the fare for the trip taken.

It has become increasingly evident that there is a need for a graduated fare structure to require each customer to pay according to his use of the transit system. It is also necessary to provide a zoned fare structure such that it may be easy for the customer to use and as automatic as possible. Preferably, it should be similar to a single fare structure in order to reduce the cost of operation as much as possible and make it as easy as possible for the customer to utilize the transit system.

It has been proposed to provide a transit system using tickets and special types of turnstiles or gates to provide for automatic fare collection of a zoned fare structure. To make the system as simple, reliable and economical as possible, it is proposed to provide tickets for use in the system, such tickets having a matrix for storing information, and to provide ticket vending machines and passenger gates to encode such matrix with the desired information. One system of this type is described and claimed in Patent Application No. 12948/68 (Serial No. 1216409), filed concurrently herewith and entitled An Automatic Fare Collection system. This invention provides a ticket which may be used in the automatic fare collection system of that application as well as other types of automatic fare collection systems. The ticket of this invention provides an information storage matrix on the ticket. It may also be desirable to provide some time limit information on the ticket so as to limit the use of tickets within a transit system using an automatic fare collection system. In this invention, the matrix of the ticket may also be used to provide a date-time code in order to limit

[Price 5s. 0d. (25p)]

the time during which the ticket may be used within the transit system.

Another problem arising from the use of tickets in automatic fare collection systems is normally the requirement that the ticket be properly oriented before it is placed in any of the equipment of the fare collection system. However, since it is known that various types of customers will be using the system and also that many customers are inattentive when it comes to using such tickets, it is considered desirable to provide a ticket for an automatic fare collection system which may be accepted by the equipment and used, as required, regardless of the orientation in which the ticket is placed in the equipment. The ticket of the present invention uses the information storage matrix to provide in such storage matrix orientation information such that the ticket may be accepted and used by the equipment of the fare collection system, regardless of the orientation of the ticket when presented to such equipment.

It is therefore an object of this invention to provide a novel transit ticket having a variable information storage matrix on the ticket.

A further object of this invention is to provide a novel transit ticket which is made of plastics or the like to provide a low cost, readily replaceable ticket which may be replaced when damaged or on the change of fare structure in the system.

It is a further object of this invention to provide a novel transit ticket wherein the ticket may be provided with provisions for time coding on such ticket.

A further object of the invention is to provide a novel transit ticket having an information storage magnetic matrix with means to indicate the orientation of the ticket.

Another object of this invention is to provide a novel ticket having an encodable magnetic matrix of discrete magnetic members which may be encoded with any desired information.

A still further object of this invention is to provide a novel transit ticket having an encodable magnetic matrix thereon which may be readily reused in the automatic fare collection system.

In carrying out this invention in a preferred form, a rectangular ticket is provided for use in an automatic fare collection system. Positioning slots are provided along the center line of the ticket and an encodable magnetic matrix for storing information during use is provided, located symmetrically about the positioning slots in two columns. The encodable matrix includes a plurality of magnetic inserts designed to be encoded in binary form to provide information as to orientation, fare paid, station origin and time-data of use. For multiple ride use, additional columns of of magnetic inserts are provided, at least one column and preferably two columns registering rides available while at least one other column and preferably two columns registers or register individual ride value.

The invention will become more readily apparent from the following description of a preferred embodiment thereof, shown, by way of example, in the accompanying drawings, in which:

FIGURE 1 is a plan view of a preferred form of single trip transit ticket according to this invention;

FIGURE 2 is a partially exploded perspective view of the ticket of FIGURE 1 showing a preferred method of fabrication; and

FIGURE 3 is a plan view of a form of multiple trip transit ticket.

This invention relates to a transit ticket which may be used for automatic fare collection on rapid transit systems. While the invention will be described with particular reference to one type of automatic fare collection, for example, that disclosed in the aforesaid application, it will be understood that this description is for illustrative purposes only and should not be considered as limiting this invention.

As discussed in the aforesaid application an automatic fare collection system may include vending machines for dispensing transit tickets and exit gates which will recognize a valid prepaid ticket and unlock to allow a customer to leave an exit station. This invention discloses a transit ticket which finds special application in the fare collection system of the aforesaid application. Of course, as will be understood, the transit ticket of this invention may also be used in other types of fare collection systems.

In an embodiment of this invention, the transit ticket is provided with a plurality of position slots and a magnetic matrix, such matrix including a plurality of magnetic inserts. The inserts are imbedded in the ticket with their major axis perpendicular to the face of the ticket. The matrix is symmetrically spaced with respect to the positioning slots and is designed for binary coding. Each magnetic insert may be encoded as a binary "zero" or "one" by driving the magnetic inserts to saturation in one of two possible polarities relative to the face of the ticket.

FIGURE 1 shows one form of a single trip transit ticket according to a preferred embodiment of this invention. As is shown in FIGURE 1, the transit ticket 10 is a rectangular member having a plurality of position holes or slots 12 punched or formed along the center line 14 of the ticket

10. In the preferred form shown, position slots 12 are rectangular in shape, although obviously, other shapes could be used if desired. Spaced symmetrically about center line 14 and position slots 12 is the variable information magnetic matrix 16. As shown, matrix 16 includes two columns 18 and 20 of magnetic inserts 22. Inserts 22 are best shown in FIGURE 2.

Referring to FIGURE 2, in the preferred form, the ticket 10 is made of a core member 24 preferably of a plastics material. The core 24 may be made of any desired material and of any thickness, however a thickness of .040" is preferred. A plurality of holes 26 are drilled, punched or otherwise formed in the core 24 on each side of the centerline 14, as is shown in FIGURE 2. Each hole 26 is filled with a magnetic insert 22. As will be understood, holes 26 could be formed during the molding of core 24 and then filled with a powdered magnetic material such as alnico. The powdered material could be provided with any type of binder as desired. Thus the term "magnetic inserts" includes both a bar type insert or a magnetic powder insert. After the magnetic inserts 22 are placed in holes 26, a plastics film is placed over the top and bottom of core 24. These films are shown as top film 28 and bottom film 30 in FIGURE 2. These films are preferably opaque to obscure the magnetic matrix 16. The ticket 10 may then be subjected to bonding by heat and pressure or other appropriate means to bind the various portions together securing the magnetic inserts 22 in the core 24. After the ticket 10 is formed as above described, or in any other desired manner, positioning slots 12 are drilled, or punched along the center line 14 of ticket 10.

Of course, as will be understood, various matter may be printed on the top and bottom of the ticket and then covered with a clear plastic material. Also, additional laminations having printed material may be added if desired. However, in the preferred form of ticket 10, positioning slits 12 will extend completely through the finished ticket. A plastics ticket as described with reference to figure 1 will be very durable and reusable in the automatic fare collection system. It is estimated that tickets as described may be reusable for at least 200 times. Of course, the tickets are relatively inexpensive and may be readily replaced as desired or necessary.

As will be understood, the magnetic inserts 22 provide a plurality of discrete magnetic bits which may be encoded in binary form with any desired information. In the form of the tickets shown in FIGURE 1, the ticket 10 is a prepaid single trip ticket. As is shown, ticket 10 has a magnetic matrix 16 in the form of a plurality of magnetic inserts 22 arranged symmetrically in two columns 18 and 20 about positioning slots 12. In the preferred form shown, each column 18 and 20 contains sixteen inserts 22. These inserts 22 are designed to contain four separate items of variable information using a group of eight inserts for each item of information. Thus, one group of eight inserts will be used to determine the orientation of the ticket. Another group will be used for fare value paid, while the remaining groups will be used for station of origin and for time-date information. Obviously, it will be clear that by merely changing the portions of the equipment, it is possible to change the various groups of inserts which are used for each item of variable information. The magnetic matrix 16 is identical for both the single trip ticket 10 shown in FIGURE 1 and the multiple trip ticket 40 shown in FIGURE 3. Since all tickets for the fare collection system have the same type of information storage matrix, the tickets can be processed in the same manner in the fare collection system equipment.

As previously mentioned, the information matrix 16 will be encoded in a binary form. This may be done by magnetizing each magnet insert 22 along its magnetic axis 32 shown in FIGURE 2. All inserts 22 will be magnetized in one or the other direction with reference to the top or face of the ticket 10. For example, a "zero" in binary form could be a north-south magnetization, while a binary "one" could be a south-north magnetization. As will be understood, the orientation group of inserts will indicate the proper orientation of ticket 10 to the fare collection equipment so that the binary coded information may be properly decoded. Each ticket 10 may be cleared after use by wiping with a unidirectional magnetic field.

The multiple trip ticket is shown in FIGURE 3 and is indicated as 40. This ticket 40 will be constructed similar to ticket 10, a preferred form of construction being shown in FIGURE 2. As shown in FIGURE 3, ticket 40 has a plurality of positioning slots 12 along center line 14 and a magnetic matrix 16 in two columns 18 and 20, symmetrically about positioning slots 12, in the same manner as ticket 10. The columns 18 and 20 also each contain sixteen magnetic inserts 22 as shown. The multiple trip ticket 40 also contains a plurality of columns 42, 44, 46 and 48 of other magnetic inserts 50. The magnetic inserts 50 are preferably cylindrical as compared to the rectangular inserts 22 and are placed in the core of the ticket in the same manner as the inserts 22. In the preferred form shown, columns 42 and 44 are designed to

indicate individual trip value using twenty-eight inserts 50. The columns 46 and 48 are designed to indicate the number of trips available using twenty inserts 50.

As will be understood, with a multiple trip ticket, the ticket would be issued for a number of trips, each for the same value. Using the twenty-eight magnetic inserts 50 shown in column 42 and 44, and assigning a monetary value of 5¢ to each insert, a maximum value of $1.40 for an individual ride is possible. However, assigning a higher monetary value to any of the inserts 50 in columns 42 or 44 would serve to raise the monetary value per ride. When ticket 40 is vended, inserts 50 would be punched out of columns 42 and 44 leaving only those inserts 50 corresponding to the value of the individual trips purchased. Obviously, ticket 40 may be vended for any specific number of individual trips, that is twenty inserts 50 in columns 46 and 48. Thus, for individual rides of $1.40 value, the ticket 40 would be vended for $28. After each use of ticket 40, one insert 50 would be punched out of one of column 46 or 48.

The use of positioning slots 12 in ticket 40 enables the ticket 40 to be stored at zero value. In the form shown, the positioning slots 12 are used with optical sensing equipment in the fare collection system, to trigger the encoding or decoding of magnetic inserts 22. By only punching out positioning slots 12 at the time the ticket 40 is vended, the ticket 40 may be stored at zero value, thus increasing the security of the tickets. Since the single trip ticket 10 will be magnetically encoded with fare paid information in the variable information storage matrix 16 at the time of vending, the positioning slots 12 may be formed in ticket 10 as it is fabricated.

From the above description it will be apparent that by means of the tickets of this invention there are provided transit tickets which may be used in the automatic fare collection system of a transit system. The ticket of this invention includes a variable information storage matrix in the body of the ticket so that it may be readily encoded and decoded by elements of fare collection equipment to collect the proper fare for any ride on the transit system. The ticket is also provided with positioning slots for maintaining the multiple ride tickets at zero value prior to the vending. The tickets of this invention are especially suited for a pay-on-entrance system as described. Also, as described, the tickets readily lend themselves for use as prepaid commuter tickets. As will be understood, by use of magnetic inserts, the ticket may be used with magnetic read and write equipment, thus providing for less complex fare collection equipment.

WHAT WE CLAIM IS:—

1. A transit ticket for use in an automatic fare collection system comprising a ticket member, a plurality of positioning slots along a center line of said ticket, and an encodable magnetic matrix in said ticket member, said encodable magnetic matrix comprising at least two columns of magnetic inserts located symmetrically about said plurality of positioning slots, each said column of magnetic inserts being encodable with information in binary form, and each of said inserts having its magnetic axis perpendicular to the face of said ticket.

2. A transit ticket as claimed in Claim 1 in which each of said columns contains sixteen magnetic inserts, said magnetic inserts being used in groups of eight for storing separate items of information.

3. A transit ticket as claimed in Claim 1 or 2, with four additional columns containing a plurality of magnetic inserts arranged symmetrically about said positioning slots.

4. A transit ticket as claimed in Claim 3 in which two of said additional columns are used to register an individual fare value and in which the other two of said additional columns are used to register the individual rides available.

5. A transit ticket for an automatic fare collection system substantially as hereinbefore described with reference to, and as illustrated in the accompanying drawings.

POTTS, KERR & O'BRIEN.

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1,216,403 COMPLETE SPECIFICATION
2 SHEETS

Fig. 1.

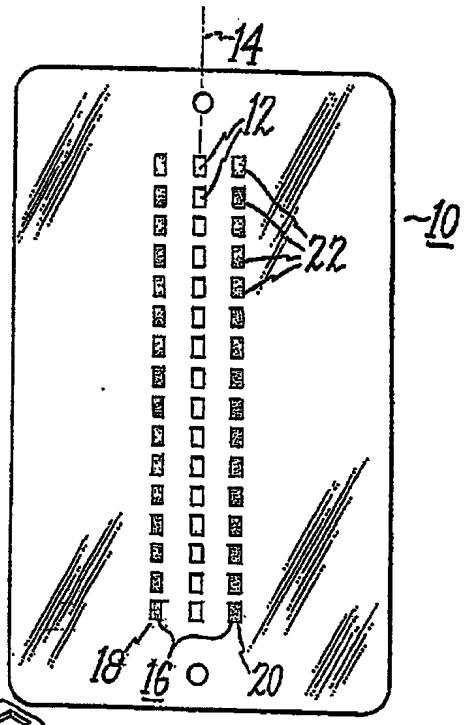
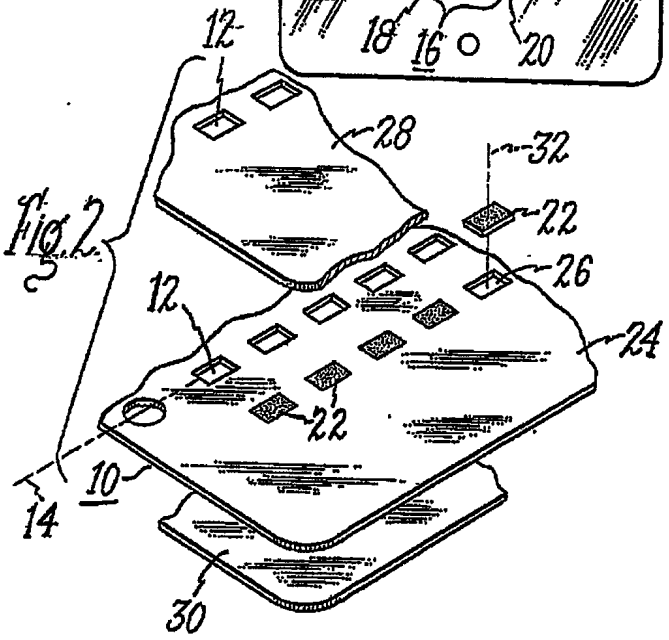


Fig. 2.



1,216,403
2 SHEETS

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.
SHEET 2

Fig. 3.